Contingency Management Interventions for HIV-related Behaviors

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Contingency management (CM) is a scientifically based treatment approach typically employed in substance abuse treatment settings to reinforce drug abstinence, counseling attendance, completion of activities, or other treatment goals. Although the application of CM to HIV management has few published studies, it shows promise as an intervention for HIV-related behaviors. CM interventions such as voucher reinforcement, prize systems, and cash incentives can be used to reduce HIV risk behaviors and to improve HIV medication adherence. CM programs have wide applicability to HIV prevention and management in clinical and community settings and can be implemented as stand-alone techniques or in combination with other interventions.

Introduction

Contingency management (CM) techniques can reduce HIV risk behaviors and improve client compliance with prescribed HIV medications. The application of CM to HIV management is a new area of research with few published studies. The following review will: 1) present an overview of contingency management and its current applications; 2) discuss extant literature on CM for HIV-related behaviors; and 3) suggest clinical implications of this research and strategies for implementation.

Overview of Contingency Management

CM is a scientifically based treatment approach derived from the operant behavioral perspective of B. F. Skinner, which emphasizes that behavior is learned and reinforced through environmental influences. Contingencies refer to the relationship between antecedents (ie, stimuli, settings, and contexts), behavior, and consequences (ie, events that follow behavior) [1]. By managing the contingencies of reinforcement, new behaviors can be developed and shaped. CM has been applied to treat medical and psychological conditions among children, adolescents, and adults (eg, pain, depression, self-injury, mental retardation, obesity, asthma, headache) in settings such as schools, hospitals, prisons, and inpatient psychiatric units [1]. CM is often employed in substance abuse treatment programs to enhance client motivation for treatment and reduce alcohol and drug use. The goals of CM are to weaken the influence of reinforcement from substance use and its associated lifestyle and to strengthen reinforcement from healthier alternate activities. CM interventions usually include voucher reinforcement, prize systems, or cash incentives.

CM voucher-based reinforcement provides an example of CM. This technique helps clients achieve and maintain abstinence from drugs by providing them with a voucher each time they perform the target behavior (ie, producing a drug-free urine specimen). Based on the token economy system used in behavior modification programs, the token or voucher is a generalized reinforcer that represents a monetary value and can be exchanged for retail goods and services consistent with the goals of treatment (eg, clothes, movie tickets, restaurants) [1]. Initially the value of the vouchers is low, but the magnitude increases with the number of consecutive drug-free urine specimens that the individual provides. Prior research indicates that a progressive or escalating schedule of reinforcement may be useful in sustaining behavior once it is achieved [2]. This system also typically includes a "reset" function when clients do not achieve the target behavior: the voucher value is reset to the initial low value following noncompliance, and clients have the opportunity to build back their earnings.

In CM, the schedule of reinforcement is the temporal relationship between the target behavior and the delivery of consequences. For optimum effectiveness, reinforcement should be applied as soon as possible following the target behavior. The schedule of reinforcement makes a difference in the effectiveness of the reinforcement program. In a continuous or "fixed ratio" reinforcement schedule, a response is reinforced each time the behavior occurs, such as receiving a voucher for each medication dose taken. The advantage of continuous reinforcement is that performance occurs at a high level while behavior is being reinforced. However, the disadvantage is that extinction is rapid once the reinforcement is removed.

Prize systems, or "fishbowl lotteries," are a good example of an intermittent or "variable ratio" reinforcement schedule. In this procedure, clients earn the chance to draw a slip of paper from a bowl and win prizes (ranging from $1 to $100) for meeting target behaviors [3]. Small prizes may include such items as socks, lipsticks, lotions, bus tokens, and $1 certificates to fast food restaurants, and large prizes include watches, VCRs, televisions, and gift certificates to book and record stores. The probability of winning a particular prize is inversely proportional to the magnitude of the prize such that small prizes are won more frequently. This system maintains features of the voucher program with increased draws for sustained abstinence and a variety of prize choices. For example, the prize reinforcement system was used to reward persons who are HIV-positive at a drop-in center for attending group therapy and completing steps related to treatment goals [4]. Prize and voucher systems seem to be equally efficacious in promoting drug abstinence [3].

Cash incentives (also known as economic, financial, or monetary incentives) are a CM technique used in a variety of settings. For example, some programs provide cash reinforcers to clients for meeting a target behavior or completing a sequence of behaviors. Cash can be used in lieu of vouchers using similar reinforcement schedules, in combination with prize systems, or as bonus payments in CM programs. One study compared cash and vouchers for attendance at AIDS prevention sessions by injection drug users and their partners. The results indicated that cash incentives were more effective than vouchers in promoting attendance [5]. Another study that compared monetary ($15 cash) and voucher incentives ($15 gift certificate for grocery, restaurant, movie tickets, subway or bus tokens) for patients at a sexually transmitted infection (STI) clinic to enroll and participate in HIV/STI prevention counseling sessions showed that monetary incentives were more effective than vouchers [6].

Contingency Management Applications

CM approaches have established efficacy in sustaining abstinence from cocaine [7], opiates [8], marijuana [9], alcohol [10], and nicotine [2]. A recent review of controlled CM studies for substance use disorders found that 47 of 55 reports (85%) demonstrated significant changes in at least one target behavior [11]. CM has also been used for changing behaviors other than drug abstinence, including compliance with treatment plan activities, homework, appropriate clinic behaviors, attendance at counseling sessions, job training, and work [12]. One study used food vouchers to reinforce patients with HIV for returning to the clinic to have a follow-up tuberculosis skin test reading [13]. Return rates for the skin reading were significantly higher for the food voucher group (48%) and the food voucher plus patient education group (61%) compared with a control group (35%). Another study of syringe-exchange participants showed that cash incentives were effective in promoting adherence to referral for chest x-rays after tuberculin skin testing compared with standard referral (83% vs 34%, respectively) [14]. Financial incentives (ie, $25 cash) were used to increase HIV testing by patients who were referred from a hospital emergency department [15]. These researchers found that the proportion of patients who completed counseling and testing was increased when incentives were offered (23%) compared with control periods when the incentives were not offered (8% and 11%). A peer-intervention to increase adherence with HIV treatment incorporated cash incentives to reward advocates if their peers succeeded in keeping weekly appointments, medical appointments, and picking up prescriptions on time [16]. Reinforcing patients for completing activities such as attending medical appointments is a CM procedure that not only complements standard clinical practices but also has implications for improved psychosocial functioning [12].

Contingency Management for HIV Risk Reduction

Many studies have reported that drug treatment interventions lead to reductions in HIV risk behavior [17]. No research to-date has evaluated CM interventions that specifically target HIV risk behaviors, although two studies have looked at the changes in HIV risk behaviors associated with CM for drug abstinence. Secondary analysis was performed on data from a clinical trial comparing cognitive behavioral therapy (CBT) and voucher-based CM for cocaine-use in methadone patients [18•]. Vouchers were provided contingent upon cocaine-negative urine specimens beginning at $2.50 and escalating as the number of consecutive cocaine-negative urine specimens increased (potential earnings = $1155 for 12 weeks). The results showed overall reductions in self-reported HIV risk behaviors (ie, injection, needle-sharing, unprotected sex, trading sex for money/drugs) across all treatment groups. The CM-only group had odds ratios between 2 and 3 for ceasing HIV risk behaviors compared with the control group.

Another study compared CBT and CM for methamphetamine dependence among gay and bisexual men [19•]. The primary measure of HIV-related sexual risk was the Behavioral Questionnaire-Amphetamine administered in an interview format on a monthly basis. CM consisted of voucher reinforcement therapy for methamphetamine abstinence based on an escalating schedule. Urine specimens were collected three times per week, and vouchers worth $2.50 were given for drug-free samples with a $10 bonus for consecutive drug-free samples (potential earnings = $1277.50 for 16 weeks). The findings of this study also showed HIV risk behavior reduction in all treatment groups, including CM, at 6- and 12-month follow-up. Unprotected, insertive anal intercourse decreased signifi-

cantly compared with baseline (17% vs 37%, respectively), and the number of reported sexual partners in the past month decreased by more than 50% from baseline.

Contingency Management for Medication Adherence

For patients who have difficulty taking medications as directed, positive reinforcement can be used to promote adherence. Previous studies show improved isoniazid compliance with tuberculosis treatment [20,21] and naltrexone ingestion among opioid-dependent patients [22,23] using CM procedures. Monetary incentives also improved hepatitis B vaccine three-part dose completion compared with street outreach among injection drug users (69% vs 23%, respectively) [24].

The first published investigation of CM for antiretroviral adherence was a pilot that compared three conditions: control training (ie, encouragement), cue-dose training (ie, identifying cues), and cue-dose training plus cash reinforcement [25]. This randomized, controlled study ($N = 55$) used the Medication Events Monitoring System (MEMS) to track antiretroviral adherence. MEMS is an electronic monitor that compiles dosing data using a standard plastic vial with a cap containing a microelectronic circuit that registers openings and closings. Events stored in the MEMS cap memory are transferred through a desktop communicator to a computer program that reads and stores the data, calculates results, presents visual displays, and prints reports based on patient data. In this study, reinforcement was based on one "primary" medication placed in the MEMS bottle, and patients were encouraged to cue other medications to this one. Cash reinforcement was given to participants at weekly meetings for each dose of the primary medication taken within 2 hours of the prescribed dosing time (target behavior). Reinforcement began at $2 per dose and increased with each consecutive dose to a maximum of $10 per day (possible earnings = $280 for 4 weeks). The reinforcement was reset to $2 if a dose was not taken within 2 hours of the set dosing time. Study results demonstrated that the group receiving cue-dose training plus monetary reinforcement had significantly higher adherence during the intervention period compared to the other two groups. The mean adherence in the reinforced group increased from 70% at baseline to 88% at week 1. The authors suggest that this rapid improvement was due to the motivating effect of reinforcement rather than new skill acquisition from cue-dose training. These adherence improvements were not sustained during the follow-up period, and the study did not show an effect of improved adherence on viral load.

Our group evaluated a CM intervention designed to improve antiretroviral adherence among HIV-positive patients on methadone maintenance [26••]. The study represents a novel application of CM as the first reported application of voucher-based reinforcement to HIV medication adherence. After a 4-week baseline observation phase, eligible participants ($n = 66$) were randomly assigned to a voucher group (medication coaching plus voucher reinforcement) or comparison group (medication coaching only). The voucher values increased for each consecutive day MEMS openings were within a 4-hour window of the scheduled dose time but reset to the original amount when the MEMS bottle was not opened on time for a scheduled dose. Participants could earn as much as $1172.40 in vouchers for taking all medication doses as scheduled through the 12-week intervention period (Table 1). Significant mean adherence differences were found between voucher and comparison groups using MEMS electronic measurement (78% vs 56%), self-report (87% vs 69%), and pill count (86% vs 75%), respectively. Differences between groups faded after vouchers were discontinued during the 4-week follow-up period, and there was no significant effect on viral load.

This study nicely demonstrates the behavioral principles of contingency management and the application of CM to HIV medication adherence. There were many opportunities for the target behavior of medication-taking to occur (ie, two times per day for 12 weeks = 168 opportunities). Tangible reinforcers in the form of voucher payments were provided in close proximity to when the target behavior (ie, MEMS opening) was clearly and objectively demonstrated. Voucher payments were withheld when the medication bottles indicated nonadherence. Positive social reinforcement by medication coaches was employed to increase involvement in healthy behaviors that contribute to treatment goals.

Building on the findings of these two studies, a recent clinical trial investigated a prize system CM intervention for antiretroviral adherence among HIV clinic patients with a history of substance abuse [27••]. Participants ($n = 56$) with suboptimal adherence (< 80%) during a 4-week baseline were randomly assigned to 16 weeks of CM plus adherence and substance abuse counseling or supportive counseling only, and followed for an additional 16 weeks. CM reinforcement was based on MEMS openings within 3 hours of the scheduled dose time and consisted of a prize system with draws of cards from a bowl and bonus draws for consecutive weeks of perfect adherence. The cards were replaced after each draw and the odds of winning were: 26.7% to earn $1, 7.6% for $20, and 0.2% chance to earn $100. The cards could be redeemed for prizes and gift certificates (potential total earnings = $800). Results indicated that the CM group had significantly improved adherence over the supportive counseling condition using MEMS (76% vs 44%) and self-report (81% vs 70%) and lower viral load ($\log_{10}$ 3.3 vs $\log_{10}$ 2.9, respectively). Similar to the above studies, there was not a significant difference between the two groups during the follow-up period. The authors suggest that the CM approach should be modified or extended so that benefits can be sustained. Strategies might include post-

Table 1. Medication adherence reinforcement schedule

Intervention week	Day	Dose no.	Increase per day	Amount per day	Amount per dose	Cumulative earnings
1	1	1	$1.00	$1.00	$0.50	$0.50
	1	2			$0.50	$1.00
	2	3	$1.40	$2.40	$1.20	$2.20
	2	4			$1.20	$3.40
	3	5	$1.40	$3.80	$1.90	$5.30
	3	6			$1.90	$7.20
	4	7	$1.40	$5.20	$2.60	$9.80
	4	8			$2.60	$12.40
	5	9	$1.40	$6.60	$3.30	$15.70
	5	10			$3.30	$19.00
	6	11	$0.20	$6.80	$3.40	$22.40
	6	12			$3.40	$25.80
	7	13	$0.20	$7.00	$3.50	$29.30
	7	14			$3.50	$32.80
…	…	…	…	…	…	…
12	82	163	$0.20	$22.00	$11.00	$1116.80
	82	164			$11.00	$1127.80
	83	165	$0.20	$22.20	$11.10	$1138.90
	83	166			$11.10	$1150.00
	84	167	$0.20	$22.40	$11.20	$1161.20
	84	168			$11.20	$1172.40

From Haug et al. [29•].

intervention booster sessions or more effective teaching so that participants internalize medication-taking skills.

CM as a treatment for substance abuse is criticized because clients often relapse when abstinence no longer earns them the reinforcers that are available during treatment. Similar findings were found with CM for medication adherence. CM may be better conceptualized as a temporary means to become abstinent or medication adherent. CM can be used as a strategy to assist clients in learning new behaviors and maintaining control over these behaviors. As new behaviors are learned, the client may obtain reinforcement from family, work, and the natural environment to maintain these behaviors. CM also seems to work well in combination with other therapies as several studies demonstrated enhanced post-treatment effects when used with CBT [9,18•,19•]. In fact, the coping skills learned in CBT may complement the shortcomings of CM [28].

Contingency Management Implementation

A treatment manual for implementing CM for antiretroviral adherence with methadone clients who are HIV-positive is available [29•]. The manual describes CM intervention procedures in detail, including voucher incentives and the fishbowl lottery prize system. Another excellent resource for designing CM programs is a book entitled *Motivating Behavior Change Among Illicit Drug Abusers* [30]. This text provides an overview of innovative CM programs and strategies for addressing implementation challenges.

Adherence monitoring is an important component of CM interventions for HIV medications. Most studies use MEMS as the primary outcome because it is an objective method of adherence for calculating vouchers that clients and staff agree upon. Self-reported adherence is a subjective measure with potential for bias, particularly when clients are trying to earn vouchers. MEMS caps have limitations as well. For example, clients may have opened their medication bottles in order to obtain voucher credit but not actually ingested the medication. MEMS are also expensive, cumbersome, and track only one medication. Ultimately, there is no ideal measure of adherence, and combining multiple measures may give the most accurate viewpicture (eg, counts of pills returned, pharmacy records of prescriptions filled, self-reports).

The front-end cost of supporting voucher program incentives is a concern when integrating contingency management procedures into clinical and community settings. Variable schedules (ie, prize systems) may lower cost without reducing the effectiveness of the CM program. Creative strategies are delineated for reducing costs asso-

ciated with voucher rewards, including the solicitation of donated goods and services from local merchants in the community [31]. One group purchased voucher incentives with funds donated from health care organizations, businesses, and foundations [32]. Clinics and providers must decide which types of vouchers are consistent with their objectives and mission. Some clinicians have concerns about giving out cash, so vouchers may be preferable for substance-abusing HIV populations when designing a CM program. Voucher or prize selection can be used to support treatment goals (eg, providing baby-store vouchers to pregnant or parenting mothers). Another option is to replace voucher reinforcers with contingently allocated clinic privileges or other external opportunities (eg, housing, social security disability payments) [33].

Conclusions

CM interventions—such as voucher reinforcement, prize systems, and cash incentives—are effective methods for increasing HIV antiretroviral adherence while reinforcers are being applied. No studies to-date have directly applied CM to HIV risk behaviors. Although secondary analysis suggests reduced risk associated with CM for drug abstinence, participants' self-reports were not corroborated. Long-term efficacy of CM has yet to be demonstrated in both substance abuse and HIV treatment. Many programs incorporate CM as an adjunct to existing therapies or standard care. CM programs have wide applicability in clinic and community settings and can be implemented as stand-alone techniques or in combination with other interventions such as CBT. Clients who are HIV-positive and abusing illicit substances may particularly benefit from CM. Further research on CM interventions for HIV management is needed to establish CM as a viable prevention intervention and treatment for HIV-related behaviors.

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